RCA AF TRANSISTORS

40422
40423
40424
40425
40426
40427

RCA-40422, 40423, 40424, 40425, 40426, and 40427* are high-voltage power transistors of the silicon npn type, primarily intended for use as class A amplifiers in af-output stages of ac- and ac/dc-line-operated radio receivers, phonographs, television receivers, and other entertainment-type electronic equipment.

These transistors have very high collector-voltage ratings (300 V max.), high dissipation capabilities (up to 8 W max.), low feedback capacitance (5 pF typ.), and a high gain-bandwidth product (25 MHz). They can provide high power output with low distortion and excellent frequency-response characteristics in economical circuit designs.

Types 40422 through 40427 comprise two groups of three transistors each (40422, 40424, 40426 and 40423, 40425, 40427), which differ only in mechanical configuration and dissipation capability. The three transistors in each group provide a choice of three different dc beta (h_{FE}) ranges, but are identical in all other respects.

Types 40422, 40424, and 40426 are hermetically sealed in JEDEC TO-66 flanged metal packages, and are intended for applications in which the mounting-flange (case) temperature is controlled by the use of external heat sinks or other means. These types have a maximum dissipation capability of 8 watts at mounting-flange temperatures up to 70° C.

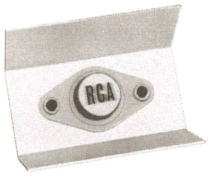
Types 40423, 40425, and 40427 are also hermetically sealed devices in JEDEC TO-66 packages, but are provided with integral aluminum cooling flanges and solder-type mounting pins. These types are intended for mounting on printed-circuit boards, and have a maximum dissipation capability of 3.8 watts at ambient temperatures up to 55° C.

In typical line-operated amplifier circuits (see Figs. 2, 3, and 4) RCA-40422, 40424, and 40426 can deliver power outputs of 2 watts or more, and RCA-40423, 40425, and 40427 power outputs of 1 watt or more, with less than 10% total harmonic distortion.

SILICON NPN HIGH-VOLTAGE POWER TRANSISTORS

For Class A AF Power-Amplifier Service In Line-Operated Radios, Phonographs, and Television Receivers

40422, 40424, 40426
(JEDEC TO-66)



40423, 40425, 40427
TOP VIEW
JEDEC TO-66
WITH HEAT RADIATOR

- High breakdown voltages:
  BV_{CBO}, BV_{CEX} = 300 V min.
- High dissipation capabilities:
  40422, 40424, 40426: P_T = 8 W max. at T_{MF} to 70° C
  40423, 40425, 40427: P_T = 3.8 W max. at T_A to 55° C
- High power-output capabilities in economical line-operated circuit designs:
  40422, 40424, 40426: $P_O \geq 2$ W at < 10% THD
  40423, 40425, 40427: $P_O \geq 1$ W at < 10% THD
- High gain-bandwidth product for excellent hf response:
  f_T = 25 MHz typ.
- Low output capacitance:
  C_{ob} = 5 pF typ.
- Wide operating-temperature range:
  -65 to +150° C
- Hermetically sealed JEDEC TO-66 metal packages
- Collector internally connected to mounting-flange and case for effective heat transfer
- Pin-type base and emitter terminals

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* Formerly Dev. Nos. TA2868, TA2868A, TA2700, TA2702, TA2867, and TA2867A, respectively.

RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.

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Maximum Ratings, *Absolute-Maximum Values:*

	40422 40424 40426	40423 40425 40427	
COLLECTOR-TO-BASE VOLTAGE, V_{CBO}	300	300 max.	V
COLLECTOR-TO-EMITTER VOLTAGE, V_{CEX}: (Sustaining value at I_C = 5 mA, I_B = 5 μA)	300	300 max.	V
EMITTER-TO-BASE VOLTAGE, V_{EBO}	2	2 max.	V
COLLECTOR CURRENT, I_C	150	150 max.	mA
BASE CURRENT, I_B	150	150 max.	mA
EMITTER CURRENT, I_E	150	150 max.	mA
TRANSISTOR DISSIPATION, P_T:			
At mounting-flange temperatures** up to 70° C .	8	–	W
At mounting-flange temperatures** above 70° C.	See Fig.1	–	–
At ambient temperatures up to 55° C .	–	3.8 max.	W
At ambient temperatures above 55° C.	–	See Fig.1	
TEMPERATURE RANGE:			
Storage and operating	-65 to +150		°C
LEAD TEMPERATURE (During soldering):			
At distances not closer than 1/32 inch to seating surface for 10 seconds max..	255	255 max.	°C

** Measured at center of seating surface.

RATING CHART FOR 40422, 40423, 40424, 40425, 40426, AND 40427

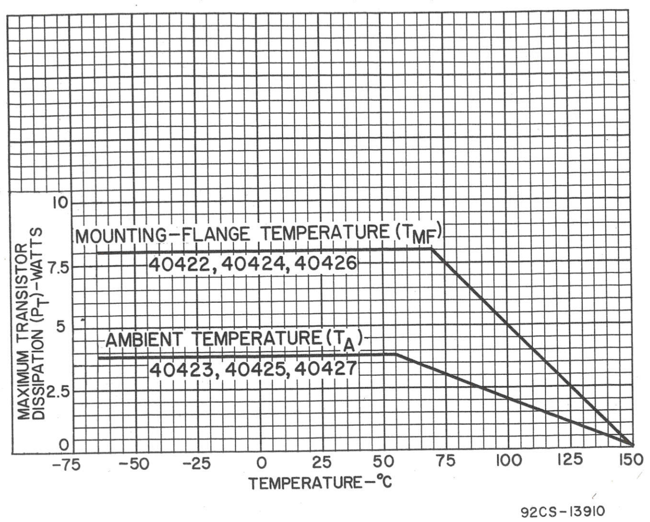


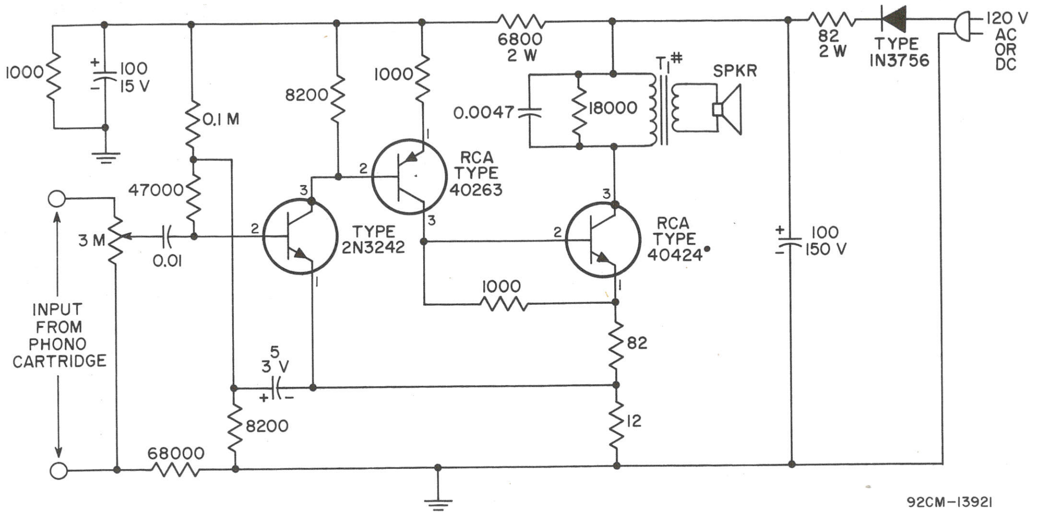
Fig.1

ELECTRICAL CHARACTERISTICS, *at a Mounting-Flange Temperature (T_{MF}) of 25° C**

Characteristics	Symbols	TEST CONDITIONS					LIMITS									Units
		DC Collector-to-Base Voltage V_{CB}	DC Collector-to-Emitter Voltage V_{CE}	DC Base Current I_B	DC Emitter Current I_E	DC Collector Current I_C	RCA 40422 40423			RCA 40424 40425			RCA 40426 40427			
		V	V	μA	mA	mA	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	
Collector-Cutoff Current	I_{CBO}	300			0		–	–	100	–	–	100	–	–	100	μA
Collector-Cutoff Current	I_{CEX}		300	5			–	–	5	–	–	5	–	–	5	mA
Emitter-to-Base Breakdown Voltage	BV_{EBO}				0.1	0	2	–	–	2	–	–	2	–	–	V
Static Forward Current-Transfer Ratio	h_{FE}		10			50	50	80	250	30	60	150	20	35	100	—
Gain-Bandwidth Product	f_T		50			20	–	25	–	–	25	–	–	25	–	MHz
Open-Circuit Common-Base Output Capacitance	C_{ob}	50			0		–	5	–	–	5	–	–	5	–	pF
Extrinsic Base-Lead Resistance	$r_{bb'}$	f = 100 MHz	50			20	–	20	–	–	20	–	–	20	–	Ω
Thermal Resistance: Junction-to-Mounting Flange*	$\theta_{J\text{-}MF}$						RCA-40422 –	8	10	RCA-40424 –	8	10	RCA-40426 –	8	10	°C/W
Thermal Resistance: Junction-to-Free Air	$\theta_{J\text{-}FA}$						RCA-40423 –	–	25	RCA-40425 –	–	25	RCA-40427 –	–	25	°C/W

* Measured at center of seating surface.

2-WATT LINE-OPERATED PHONO-AMPLIFIER USING RCA-40424



TYPICAL PERFORMANCE CHARACTERISTICS:

Sensitivity for 2 W output at 1 kHz = 550 mV
Power output at 10% total harmonic distortion = 2 W (RMS)
Frequency response 100 Hz to 10 KHz
Hum and noise -63 dB (below 2 W)

# T_1 = 2500: 3.2 ohms
(Freed type RGA-8, Triad type S-12X, or equivalent)

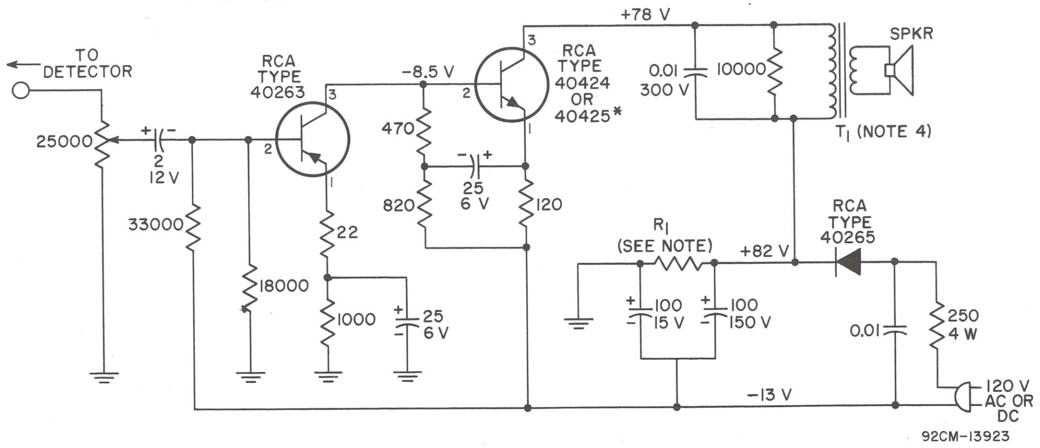
• RCA 40424 mounted on heat sink having a thermal resistance ≤ 5° C/W

All resistors in ohms, 1/2 watt, composition, 10% tolerance, unless otherwise specified

All capacitors in microfarads

Fig.2

1-WATT AUDIO AMPLIFIER FOR USE IN LINE-OPERATED RADIOS



PERFORMANCE DATA

Power Output = 1 W min. at 10% total harmonic distortion
Sensitivity: 3 mV for 50 mW output
16 mV for 1 W output

Power Gain: 72 dB
Z_{in}: 3000 Ω typ.
Hum & Noise: Zero vol. -70 dB } 1 W
Full vol. -58 dB } Ref.

Freq. Resp.: 120 Hz to 7.6 KHz (-3 dB)

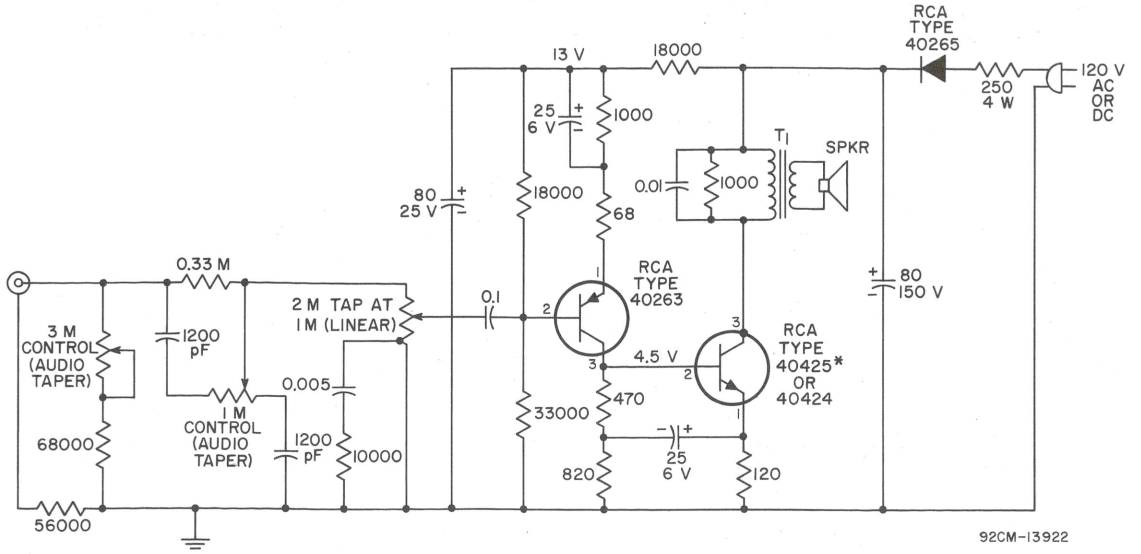
* 40425 may be mounted directly on printed-circuit board with no additional heat sink for operation at ambient temperatures up to 55° C.

NOTES

1. All measurements taken at 120 V line input and at frequency of 1 KHz.
2. All voltages referred to circuit ground.
3. Value for R_1 is 3900 Ω/2 watts based on 15 mA front-end drain-not including 40263 current.
4. T_1: 2500 Ω to voice coil impedance Freed Type RGA-8 or Triad Type S-12X or similar commercial-grade plate-to-voice coil transformer.
5. Resistors are in ohms, 1/2 watt, composition, 10% tolerance, unless otherwise specified.
6. Capacitors are in microfarads

Fig.3

1-WATT LINE-OPERATED PHONO-AMPLIFIER FOR USE WITH CRYSTAL CARTRIDGES



Power Output = 1 W. @ 10% total harmonic distortion
Sensitivity: 2 V for 1 W output
T1: 2500 to 3.2 ohms
(Freed Type RGA-8 or Triad Type S-12X or equiv.)

All resistors in ohms, 1/2-watt, composition, 10% tolerance, unless otherwise specified

All capacitors in microfarads unless otherwise specified

* 40425 may be mounted directly on printed-circuit board with no additional heat sink for operation at ambient temperatures up to 55° C.

Fig.4

TYPICAL INPUT CHARACTERISTIC FOR RCA TYPES 40422, 40423, 40424, 40425, 40426, AND 40427

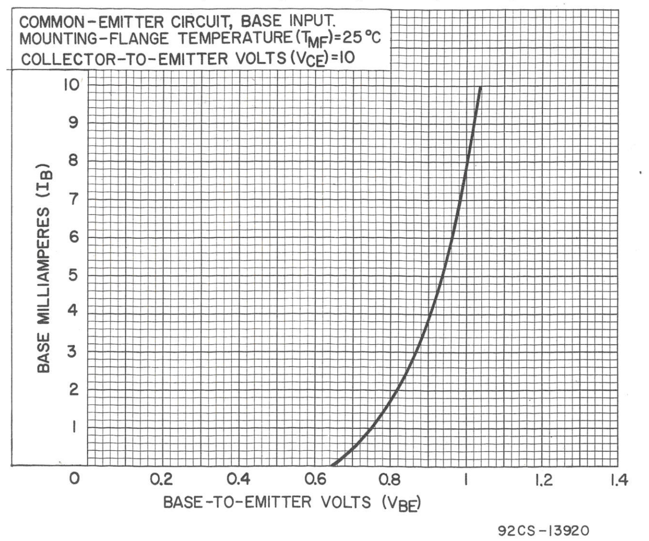


Fig.5

TYPICAL TRANSFER CHARACTERISTIC FOR RCA TYPES 40422, 40423, 40424, 40425, 40426, AND 40427

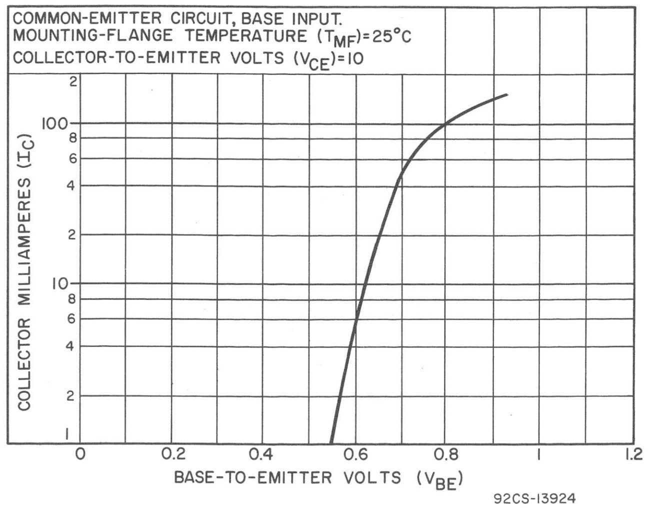


Fig.6

STATIC BETA (h_{FE}) vs. COLLECTOR CURRENT FOR RCA TYPES 40422 AND 40423, 40424 AND 40425, AND 40426 AND 40427

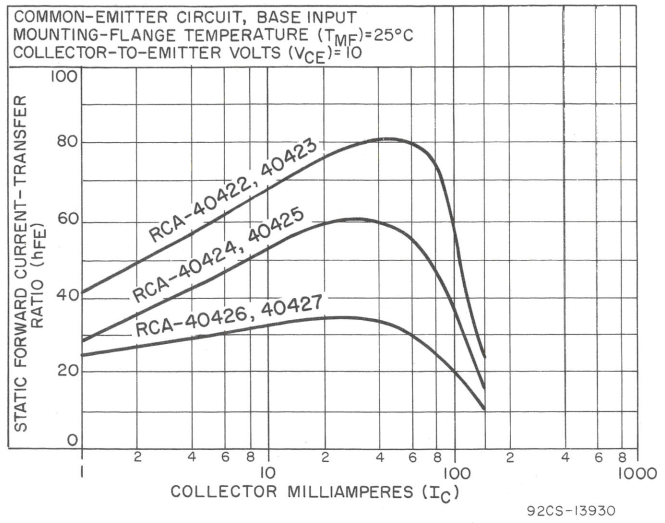


Fig.7

TYPICAL COLLECTOR CHARACTERISTICS FOR RCA TYPES 40422, 40423, 40424, 40425, 40426, AND 40427

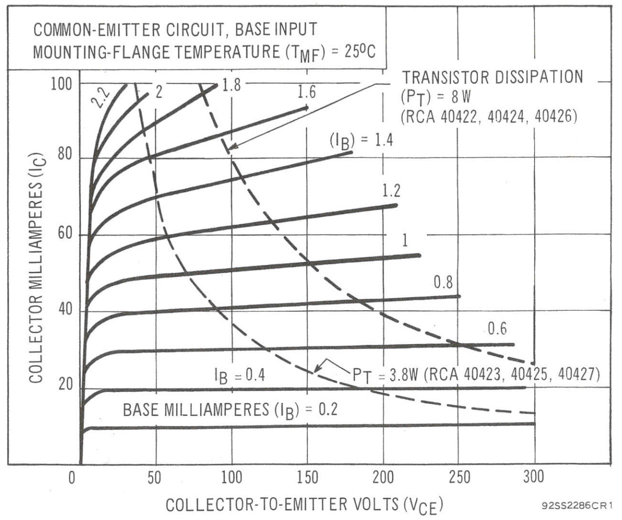


Fig.8

OPERATING CONSIDERATIONS

The *maximum ratings* in the tabulated data are established in accordance with the following definition of the *Absolute-Maximum Rating System* for rating electron devices.

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron device of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

The device manufacturer chooses these values to provide acceptable serviceability of the device, taking no responsibility for equipment variations, environment variations, and the effects of changes in operating conditions due to variations in device characteristics.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any device under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in device characteristics.

The devices described in this bulletin should not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the devices.

Because the metal shells of these transistors operate at the collector voltage, consideration should be given to the possibility of shock hazard if the shells are to operate at voltages appreciably above or below ground potential. In such cases, suitable precautionary measures should be taken.

It is essential that the mounting flanges of the 40422, 40424, and 40426, which are internally connected to the collectors, be securely fastened to heat sinks, which may be the equipment chassis. UNDER NO CIRCUMSTANCES, HOWEVER, SHOULD THE MOUNTING FLANGE BE SOLDERED TO THE HEAT SINK OR CHASSIS BECAUSE THE HEAT OF THE SOLDERING OPERATION WILL PERMANENTLY DAMAGE THE TRANSISTOR.

The mounting-flange temperature of the 40422, 40424, or 40426 will be higher than the ambient (free-air) temperature by an amount which depends on the heat sink used. The heat sink must have sufficient thermal capacity to assure that the heat dissipated in the heat sink itself does not raise the transistor-mounting-flange temperature above the design value.

Depending on the application, the heat sink or chassis may be connected to either the positive or negative terminal of the voltage supply.

In applications where the 40422, 40424, or 40426 is mounted on a chassis which is connected to the negative terminal of the voltage supply, it will be necessary to use an anodized aluminum washer having high thermal conductivity, or a 0.002" thick mica insulator between the mounting flange and the chassis. If an aluminum washer is used, it should be drilled or punched to provide the two mounting holes and the clearance holes for the emitter lead and base lead. The burrs should then be removed from the washer and the washer finally anodized. To insure that the anodized insulating layer is not destroyed during mounting, it will also be necessary to remove the burrs from the holes in the chassis. Furthermore, to prevent a short circuit between the mounting bolts and the chassis, it is important that an insulating washer be used between each bolt and the chassis.

Protection Against Transient Voltages

In a transistor class A af output-amplifier stage using transformer coupling between the transistor and the load, the collector voltage may reach instantaneous values as great as 5 to 7 times the dc supply voltage. These high voltages are usually transients developed when the transistor is overdriven to a very high value of collector current and is then abruptly cut off.

The peak value of the transient voltage will depend on the inductance, capacitance, and resistance of the output transformer and load, and on the value of the collector current immediately prior to cutoff. [The reactive components of the transformer and load act like a parallel-resonant circuit, with series and shunt damping (loss) elements provided by the associated resistances.] For a given set of load-circuit conditions the peak value of the transient voltage will be directly proportional to the collector current, and can be limited to a value within the maximum rating for the transistor by limiting the maximum value of the collector current — that is, by limiting the dynamic range of the transistor.

In most cases this type of limiting can be accomplished, and the desired maximum power output obtained without clipping and without compromise in performance or cost factors, by a judicious choice of circuit constants. The amplifier circuits shown in Figs. 2, 3, and 4 of this Bulletin have been designed with these considerations in mind, and provide protection against excessive collector voltages without the use of transient-suppression devices. It is also possible to use other combinations of circuit constants which will provide the degree of collector-current limiting and output-circuit damping necessary to keep transient-voltage peaks within the collector-voltage rating for the output transistor. For further information on this subject consult your RCA Field Representative.

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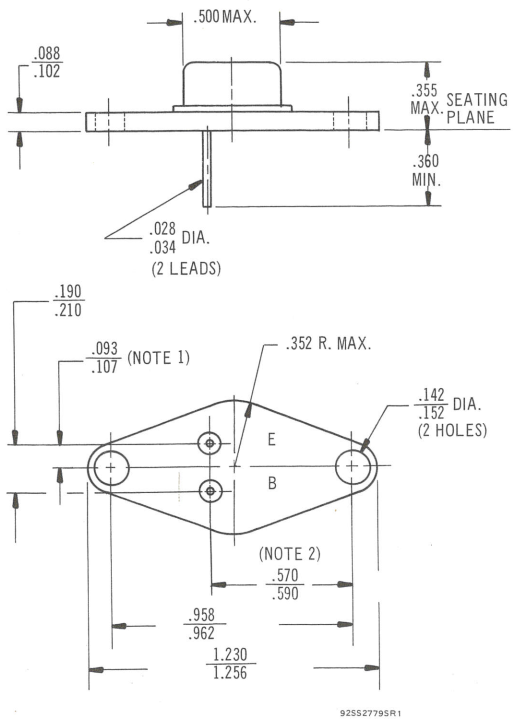
DIMENSIONAL OUTLINE
40422, 40424, 40426



Dimensions in Inches

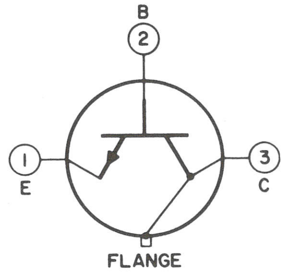
NOTE 1: MEASURED AT SEATING PLANE

NOTE 2: MEASURED AT SEATING PLANE ON RCA 40422, 40424, 40426

MEASURED AT UNDERSIDE OF ALUMINUM COOLING FLANGE ON RCA 40423, 40425, 40427

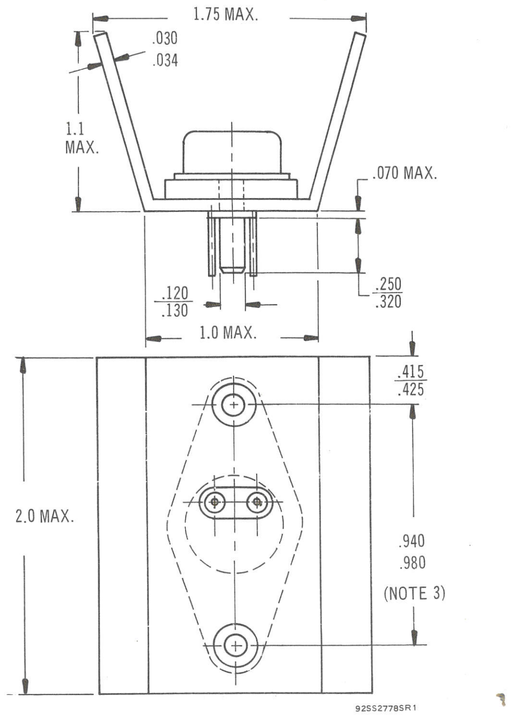
TERMINAL DIAGRAM

RCA
40422, 40423
40424, 40425
40426, 40427



Lead 1 - Emitter
Lead 2 - Base
Lead 3 - Collector
Collector is Connected to the Mounting Flange

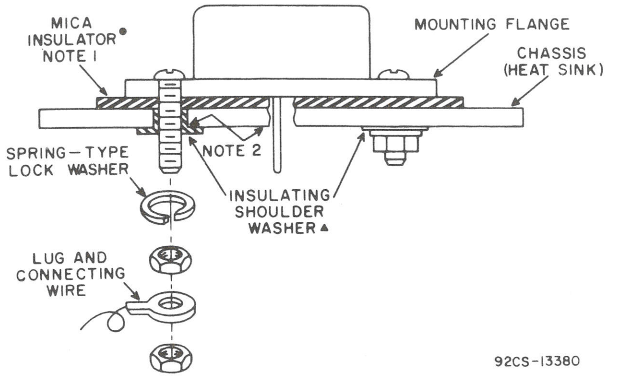
DIMENSIONAL OUTLINE
40423, 40425, 40427



Dimensions in Inches

NOTE 3: MEASURED BETWEEN CENTER LINES OF TIPS OF MOUNTING PINS

SUGGESTED MOUNTING ARRANGEMENT FOR RCA-40422, 40424, 40426



NOTE 1: 0.002" thick mica or anodized aluminum insulator drilled or punched with burrs removed.

NOTE 2: Remove burrs from chassis holes.

● Available from RCA Distributors as Part No.DF31A. Also available from Reliance Mica Co., 341-351 39th St., Brooklyn, N.Y. 10032, United Mineral & Chemical Corp., 16 Hudson St., N.Y., N.Y. 10014, and other suppliers of similar components.

▲ Available from RCA Distributors as Part No.495334-7. Also available from Contour Plastics, Minneapolis, Minn. and other suppliers of similar components.

■ RCA-40422, 40424, and 40426 fit socket PTS-4 (United International Dynamics Corp., 2029 Taft St., Hollywood, Fla.), or equivalent.

40422, 40423, 40424, 40425, 40426, 40427

SILICON NPN HIGH-VOLTAGE POWER TRANSISTORS

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